Mixed Reality Image Guidance for Cardiac Interventional Surgery

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Background & Unmet Need

• Minimally invasive, image-guided cardiac interventions are increasingly available as substitutes for more invasive surgical approaches
• With these minimally invasive procedures, tools for visualization are needed to improve guidance and lower learning curves
• Current visualization techniques like fluoroscopy are limited to 2D projections, or are unable to give real-time feedback like pre-operative CT/MRI
• Advanced fusion imaging visualizations still don’t provide quantitative tracking of the catheters in 3D space, and so cannot be used to guide catheter depth or orientation
• **Unmet Need:** Real-time, visual guidance systems for cardiac procedures wherein the catheter can be tracked in 3D space using a single fluoroscopic view

Technology Overview

• **The Technology:** A novel, mixed reality guidance system which combines holographic representations of the heart and tracking of catheter position in real time
• A 3D, holographic representation of the heart is generated using preoperative cardiac CT images
• The catheter is tracked via intra-operative fluoroscopy, and machine learning is used to locate the depth of catheter in 3D space from a single angled view
• The position of the tracker and 3D image of the heart are co-registered and transferred into an MR image in real-time, visualized by see-through video glasses

• **PoC Data:** Optimized machine learning models for locating the catheter have demonstrated a Euclidian distance error of <2 mm for certain test data sets

Inventors:
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Patents:
US Application Filed

Publications:

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Cornell Reference:
D-9607

MR: Mixed Reality
Mixed Reality Image Guidance for Cardiac Interventional Surgery

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<th>Technology Applications</th>
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<tr>
<td>• Real-time, mixed reality visualization for cardiac interventional surgery</td>
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<td>• Improved preoperative planning for cardiac interventions</td>
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<th>Technology Advantages</th>
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<tr>
<td>• Catheter is visualized in 3D space in real time, allowing for better navigation</td>
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<td>• Models reflect individual patients’ heart architectures, enabling precise and individualized surgeries</td>
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<td>• Quantitative feedback will provide real-time guidance and post-intervention analytics</td>
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**Figure 1:** Mixed reality image of a heart model and catheter in a training application.